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The Global Drivers of Photosynthesis and Light Use Efficiency Seasonality: A Granger Frequency Causality Analysis

ABSTRACT

Photosynthesis and light use efficiency (LUE) are major factors in the evolution of the continental carbon cycle due to their contribution to gross primary production (GPP). However, while the drivers of photosynthesis and LUE on a plant or canopy scale can often be identified, significant uncertainties exist when modeling these on a global scale. This is due to sparse observations in regions such as the tropics and the lack of a direct global observation dataset. Although others have attempted to address this issue using correlations (Beer, 2010) or calculating GPP from vegetation indices (Running, 2004), in this study we take a new approach. We combine the statistical method of Granger frequency causality and partial Granger frequency causality with remote sensing data products (including sun-induced fluorescence used as a proxy for GPP) to determine the main environmental drivers of GPP across the globe.